CALIFORNIA
OCCUPATIONAL GUIDES

Employment Development Department
State of California

CARTOGRAPHERS (MAP MAKERS)

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INTEREST AREA
MECHANICAL - TECHNICAL AND PROFESSIONAL

WHAT DOES A CARTOGRAPHER DO?

CARTOGRAPHERS make maps. Cartography involves many processes that require the skills of a wide range of specialists and technicians. Some workers in cartographic occupations perform routine work while others have technical jobs requiring years of training and experience. In large organizations, some workers may specialize in one function such as compiling or editing. In smaller organizations, job duties may be combined according to the type of maps produced.

Technology is revolutionizing the methods used to make maps. Cartographers use computers in their work more and more. Geographic, geodetic, political, and cultural information is fed into a computer and stored until a particular map is needed. Computer-Aided Drafting (CAD) systems allow map lines to be drawn on computer screens with information processed at the push of a button. Computer-Assisted Cartography (CAC) and Computer-Aided Mapping (CAM) also refer to this automation process. Other modern data gathering techniques include aerial photography, satellite imagery, and advanced remote sensing electronic data collection techniques. Earth data-gathering satellites, computer systems such as the Global Positioning System (GPS) and the Geographic Information Systems (GIS), and improvements in aerial photography all contribute to changes in cartographic occupations.

Following are some of the most common cartographic specialties and tasks:

Cartographers

- Develop design concept of map product.
- Define production specifications, such as projection, scale, size, and colors of new or revised map products.
- Revise existing maps and charts and correct maps in various stages of completion.
- Collect, analyze, and interpret geographic information provided by geodetic surveys, aerial photographs, and satellite data.
- Conduct research in mapping techniques and procedures.
- Analyze survey data, source maps, photographs, satellite data, and other records to determine location and names of features.

- Draw maps of geographical areas to show natural and constructed features and political boundaries.

Photogrammetrists

- Prepare original maps, charts, and drawings of inaccessible areas from aerial photographs and survey data.
- Prepare mosaic prints, contour maps, profile sheets, and related cartographic material applying mastery of photogrammetric techniques and principles.
- Apply mathematical formulas and photogrammetric techniques to identify, scale, and orient the size and shape of various topographic features.
- Lay out and match aerial photographs in sequence taken, looking for missing areas.

Stereo-Plotter Operators

- Draw topographic maps from aerial photographs using instruments which produce simultaneous projections of two photographs taken from different positions.
- Trace contours and topographical details to produce map.
- Form three-dimensional image of aerial photographs taken from different locations using mathematical aids, plotting instruments, and computers.

Map Editors

- Verify the accuracy and completeness of maps by examining aerial photographs, old maps, and records to verify correct identification of features and scaled distances.
- Store, retrieve, and compare map information using computers and data banks.

WHAT SKILLS ARE IMPORTANT?

Skills, knowledge, and abilities common to the specialists in Cartography include the following:

- Geography – Understanding various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics.
- Design – Knowing design techniques, principles, tools, and instruments.
- Mathematics – Applying knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and using mathematics to solve problems.
- Information Gathering – Knowing how to find information and identifying essential information.
- Information Organization – Finding ways to structure or classify multiple pieces of information.
- Solution Appraisal – Observing and evaluating the outcomes of a problem solution to identify lessons learned or redirect efforts.
- Computers – Understanding of hardware and software including applications and programming.

In addition, Cartographers should have good concentration and vision (including stereoscopic vision), manual dexterity, an analytical mind, and the patience to perform detailed work requiring a high degree of precision and accuracy.

WHAT'S THE WORK ENVIRONMENT?

Cartographers usually work in comfortable and pleasant offices behind a desk or drawing board. The work requires little physical activity. Most of the work is done on a computer. Few Cartographers visit the places they map.

Union Membership

Union membership depends on the size and type of employer. Many government employees belong to unions.

WHAT'S THE CALIFORNIA JOB OUTLOOK?

The following information is from the occupational projections produced by the Employment Development Department's Labor Market Information Division.

The figures represent the broad occupational group Surveying and Mapping Technicians, which includes Map Editors and Stereo-Plotter Operators.

Estimated number of workers in 1998:	4,300
Estimated number of workers in 2008:	5,200
Projected Growth 1998-2008:	20.9%
Est. openings due to separations by 2008:	1,100

These figures do not include self-employment.

Employment for this occupation is expected to grow somewhat slower than average.

The figures below represent the broad occupational group Surveying and Mapping Scientists, which includes the occupations of Cartographic Drafters and Photogrammetrists.

Estimated number of workers in 1998:	3,500
Estimated number of workers in 2008:	3,500
Projected Growth 1998-2008:	0%
Est. openings due to separations by 2008:	800

These figures do not include self-employment.

Employment for this occupation is expected to remain stable, but job openings are expected to result from the need to replace those who change occupations, retire, or otherwise leave the labor force.

Trends

Because of technical advances such as GIS and GPS, educational and computer experience requirements for entry-level workers have increased in recent years. The rise in the use of computers and more complex technologies will result in less demand for workers with only manual mapping and drafting skills. Job prospects will be better for those with a college education in engineering or a physical science, such as geography or geodesy, and training in cartography or in a closely related field.

WHAT DOES THE JOB PAY?

California Earnings

Salaries vary widely depending on experience, training, talent, type of employer, and specific tasks performed.

Surveying and Mapping Technicians 2001 Wages

Hourly wages range from	$17.63	to	$27.64
Average hourly wage	$22.97		
Average annual wage	$47,787		

Cartographers and Photogrammetrists 2001 Wages

Hourly wages range from	$17.87	to	$31.64
Average hourly wage	$25.00		
Average annual wage	$52,011		

Source: Occupational Employment Survey of Employers by EDD/LMID.

Hours

The usual workweek is 40 hours, but some workers are employed part time. Some employers may require shift and weekend work.

Benefits

Vacation and holidays, health and life insurance, and sick leave are among the benefits offered by many employers.

HOW DO I PREPARE FOR THE JOB?

Education and Training

There are several routes into cartographic occupations. Increasingly, Cartographers and Photogrammetrists complete a bachelor's degree in engineering, forestry, geography, or a physical science. Others begin as technicians, trainees, or aides and work their way up. When recruiting outside the organization, employers usually require Cartographers to have related work experience. However, some will hire trained, inexperienced applicants for entry-level positions. Besides formal education, some employers want applicants to have from one to four years of cartographic experience. This is especially true for Cartographers involved in teaching, research, supervision, or advanced mapmaking.

For the technician-level positions, employers look for applicants who have a high school education, plus two to four years of formal education in geography, geology, drafting (including CAD), mathematics, trigonometry, or related fields.

Depending upon the particular job, specialized courses such as surveying, cartography, and photogrammetry may be needed.

Preparation in high school for Cartography should include computer sciences, algebra, trigonometry, geography, and CAD.

Licensing and Certification

No state licensing requirements exist for the cartographic field. The American Society for Photogrammetry and Remote Sensing has a voluntary certification program for Photogrammetrists.

Continuing Education

The rapid growth of GIS and GPS technology in map-making calls for increased computer skills for those who want to be competitive for the better cartographic positions.

HOW DO I FIND THE JOB?

Most Cartographers work with engineering, architectural, and surveying firms, but a substantial number work for federal, regional, state, and local governments. Government agencies hire Cartographers in areas such as highway departments, land management, natural resources planning, and national defense. Many are also employed by businesses, which specialize in map publishing or map drafting services.

Direct application to employers remains one of the most effective job search methods. Private firms that may hire Cartographic occupations are listed in the yellow pages under the following headings: Computer Graphics & Digital Imaging, Engineers-Civil, Engineers Consulting, Engineers-Earthquake, Engineers-Environmental, Engineers-Geotechnical, Map Dealers & Services, Photographers-Aerial, Surveyors-Land, and Utility Companies.

Professional associations such as those listed below can be a good place to find job leads. California job openings can be found at various online job-listing systems including CalJOBS℠ at www.caljobs.ca.gov or at America's Job Bank at www.ajb.dni.us.

For other occupational and wage information and a listing of the largest employers in any county, visit the Employment Development Department Labor Market Information Web page at www.calmis.ca.gov. Find further job search assistance from your nearest Job Service office www.edd.ca.gov/jsloc.htm or the closest One-Stop site listed on the California WorkNet site, www.sjtcc.ca.gov/sjtccweb/one-stop.

WHERE CAN THIS JOB LEAD?

In large organizations workers may be promoted to a variety of senior level or supervisory positions and to department managers.

OTHER SOURCES OF INFORMATION

The American Congress on Surveying and Mapping
6 Montgomery Village Avenue, Suite 403
Gaithersburg, MD 20879
(240) 632-9716
Fax: (240) 632-1321
www.acsm.net

American Society for Photogrammetry
and Remote Sensing (ASPRS)
The Imaging & Geospatial Information Society
5410 Grosvenor Lane, Suite 210
Bethesda, MD 20814-2160
(301) 493-0290
Fax: (301) 493-0208
www.asprs.org

California Land Surveyors Association
P.O. Box 9098
Santa Rosa, CA 95405-9990
(707) 578-6016
Fax: (707) 578-4406
www.ca-surveyors.org

Employment Projections by Occupation
www.calmis.ca.gov/htmlfile/subject/occproj.htm

Employment and Wages by Occupation
www.calmis.ca.gov/file/occup$/OES$.htm

RELATED OCCUPATIONAL GUIDES

Commercial Artists	No. 4
Surveyors	No. 106
Urban Planners	No. 175
Drafting Occupations	No. 338
Geographic Information Systems (GIS) Specialists	No. 554

OCCUPATIONAL CODE REFERENCES

SOC *(Standard Occupational Classification)*

Cartographers and Photogrammetrists	17-1021
Surveying and Mapping Technicians	17-3031

O*NET *(Occupational Information Network)*

Cartographers and Photogrammetrists	17-1021.00
Surveyors	17-1022.00
Surveying Technicians	17-3031.01
Mapping Technicians	17-3031.02

OES (*Occupational Employment Statistics*)

Surveying and Mapping Scientists	22311
Surveying and Mapping Technicians	22521

DOT (*Dictionary of Occupational Titles*)

Drafter, Cartographic	018.261-010
Editor, Map	018.261-018
Photogrammetrist	018.261-026
Stereo-Plotter Operator	018.281-010